## KUBERNETES

- Kubernetes is an open source container orchestration engine for automating deployment, scaling, and management of containerized applications. The open source project is hosted by the Cloud Native Computing Foundation (CNCF).
- It provides a scalable and resilient framework for automating the deployment, scaling, and management of applications across clusters of servers.

A SMALL HISTORY OF K8S:

- In the early 2000s, Google started developing a system called Borg to manage their internal containerized applications.
- Borg enabled Google to run applications at scale, providing features such as automatic scaling, service discovery, and fault tolerance.
- In 2014, Google open-sourced a version of Borg called Kubernetes.
- Kubernetes was donated to the Cloud Native Computing Foundation (CNCF), a neutral home for open-source cloud-native projects, in July 2015.
- Kubernetes 1.8 added significant enhancements for storage, security, and networking. Key features included the stable release of the stateful sets API, expanded support for volume plugins, and improvements in security policies.

KUBERNETES ARCHITECTURE
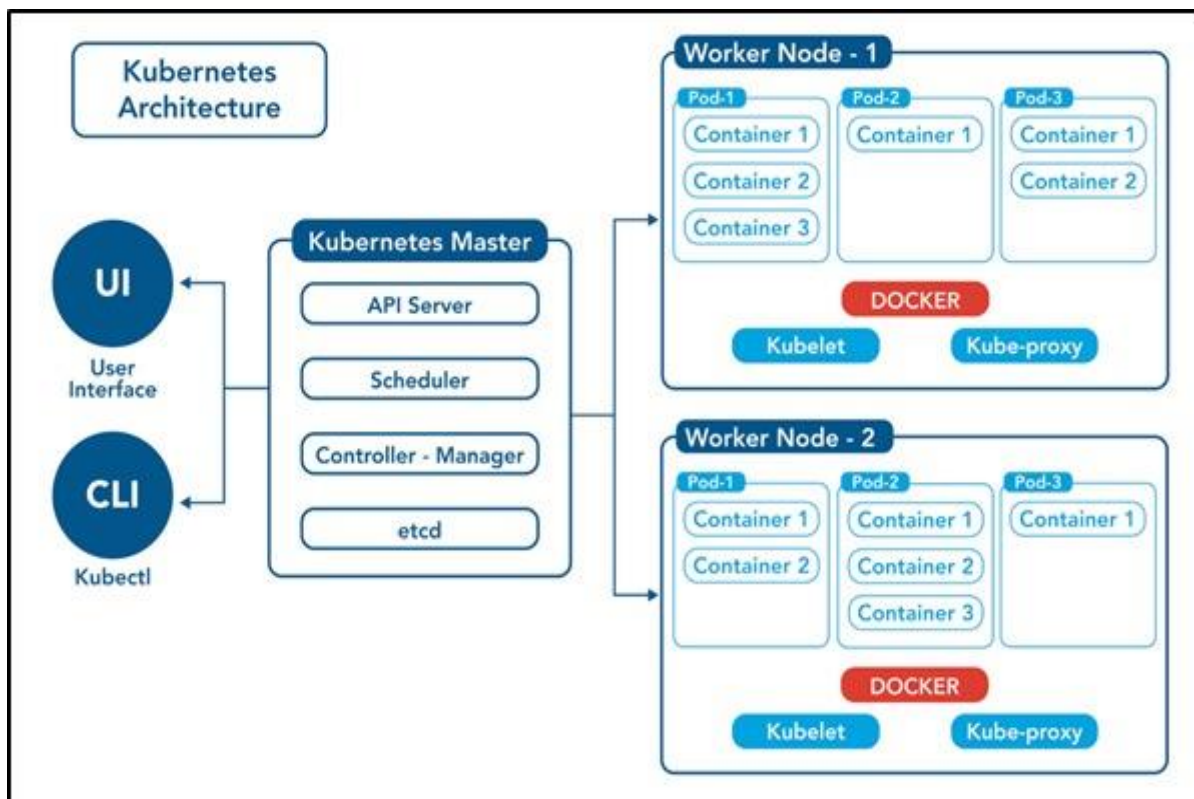
Control Plane /Master Node:

- The control plane's components make global decisions about the cluster (for example, scheduling), as well as detecting and responding to cluster events (for example, starting up a new pod when a deployment's replicas field is unsatisfied).
- Control plane components can be run on any machine in the cluster. Do not run user containers on this machine.

Node Components / Worker Nodes

Node components run on every node, maintaining running pods and providing the Kubernetes runtime environment.

- Master Node: The master node is responsible for managing the cluster and coordinating the overall state of the system. It includes the following components:
- API Server: The API server is the central control point for all interactions with the cluster. It exposes the Kubernetes API and handles requests from users and other components.
- Scheduler: The scheduler is responsible for assigning workloads (pods) to individual worker nodes based on resource requirements, constraints, and other policies.
- Controller Manager: The controller manager runs various controllers that monitor the cluster state and drive it towards the desired state. Examples include the replication controller, node controller, and service controller.
- etcd: etcd is a distributed key-value store used by Kubernetes to store cluster state and configuration data.

POD

The basic building block of Kubernetes. A pod represents a single instance of a running process within the cluster. It can encapsulate one or more containers that share the same network and storage resources.

COMMANDS

1. Create a pod using run command

$ kubectl run <pod-name> --image=<image-name> --port=<container-port>

$ kubectl run my-pod --image=nginx --port=80

2. View all the pods

(In default namespace)

$ kubectl get pods

(In All namespace)

$ kubectl get pods -A

For a specific namespace

$ kubectl get pods -n kube-system

For a specific type

$ kubectl get pods <pod-name>

$ kubectl get pods <pod-name> -o wide

$ kubectl get pods <pod-name> -o yaml

$ kubectl get pods <pod-name> -o json

3. Describe a pod (View Pod details)

$ kubectl describe pod <pod-name>

$ kubectl describe pod my-pod

4. View Logs of a pod

$ kubectl logs <pod-name>

$ kubectl logs my-pod

```
akshitha@ITP-CC16-19: ~
NAME        READY   STATUS        RESTARTS   AGE
my-pod      1/1     Running       0          54m
akshitha@ITP-CC16-19:~$ sudo nano pod.yml
akshitha@ITP-CC16-19:~$ kubectl get pod
NAME        READY   STATUS        RESTARTS   AGE
my-pod      1/1     Running       0          55m
akshitha@ITP-CC16-19:~$ sudo nano pod.yml
akshitha@ITP-CC16-19:~$ kubectl delete all --all
pod "my-pod" deleted
service "kubernetes" deleted
akshitha@ITP-CC16-19:~$ sudo nano pod.yml
akshitha@ITP-CC16-19:~$ kubectl get pod
No resources found in default namespace.
akshitha@ITP-CC16-19:~$ kubectl get pod
No resources found in default namespace.
akshitha@ITP-CC16-19:~$
akshitha@ITP-CC16-19:~$ kubectl get pod
No resources found in default namespace.
akshitha@ITP-CC16-19:~$ kubectl get pod
No resources found in default namespace.
akshitha@ITP-CC16-19:~$ kubectl get pod
No resources found in default namespace.
akshitha@ITP-CC16-19:~$ sudo nano pod.yml
akshitha@ITP-CC16-19:~$ sudo nano pod.yml
akshitha@ITP-CC16-19:~$ kubectl apply -f pod.yml
pod/my-app created
akshitha@ITP-CC16-19:~$ kubectl get pod
NAME        READY   STATUS            RESTARTS   AGE
my-app      0/1     ContainerCreating  0         8s
akshitha@ITP-CC16-19:~$ sudo nano pod.yml
akshitha@ITP-CC16-19:~$ kubectl get pod
NAME        READY   STATUS        RESTARTS   AGE
my-app      1/1     Running       0          3m34s
akshitha@ITP-CC16-19:~$
```

5. Execute any command inside Pod (Inside Pod OS)

$ kubectl exec <pod-name> -- <command>

pod.yml

apiVersion: v1

kind: Pod

metadata:

  name: my-app

spec:

  containers:

    - name: my-app-container

      image: <images>   ports:

        - containerPort: 9090

Create ReplicaSet by executing by YAML file

replicaset.yml

```yaml
kind: ReplicaSet
metadata:
  name: my-rs
  labels:
    name: my-rs
spec:
  replicas: 4
  selector:
    matchLabels:
      apptype: web-backend
  template:
    metadata:
      labels:
        apptype: web-backend
    spec:
      containers:
      - name: my-app
        image:
        ports:
          - containerPort: 8080
```

```
$ kubectl create -f rs-test.yml
# Do necessary modifications if exist, else create new
$ kubectl apply -f rs-test.yml
# Completely Modify Pod Template
$ kubectl replace –f rs-test.yml
```

View ReplicaSets

$ kubectl get replicasets

$ kubectl get rs

$ kubectl get rs –o wide

$ kubectl get rs <replica-set-name> –o json

$ kubectl get rs <replica-set-name> –o yaml

View ReplicaSet Description

$ kubectl describe rs <replica-set-name>

We can modify generated/updated YAML file

$ kubectl edit rs <replica-set-name>

change replicas: count to any other value then (ESC):wq

We can modify our YAML file and then execute apply command

$ kubectl apply -f rs-test.yml

We can Even scale using command also

$ kubectl scale replicaset <replicaset-name> --replicas=<desired-replica-count>

Delete ReplicaSet

$ kubectl delete rs <replica-set-name>

$ kubectl delete -f rs-test.yml

Create deployment by executing by YAML file

apiVersion: apps/v1

kind: Deployment

metadata:

 name: my-deploy

 labels:

  name: my-deploy

spec:

  replicas: 4

  selector:

    matchLabels:

      apptype: web-backend

  strategy:

    type: RollingUpdate

  template:

    metadata:

      labels:

        apptype: web-backend

    spec:

      containers:

      - name: my-app

        image:

        ports:

          - containerPort: 7070

kubectl create deployment webnginx2 --image=nginx:latest --replicas=1

kubectl scale deploy <deployment-name> --replicas=<desired-replica-count>

```
$ kubectl create -f web-deploy.yml

# Do necessary modifications if exist, else create new

$ kubectl create -f web-deploy.yml

# Completely Modify Pod Template

$ kubectl replace –f web-deploy.yml
```

View Deployments

```
$ kubectl get deployments

$ kubectl get deploy

$ kubectl get deploy -o wide

$ kubectl get deploy <deployment-name> -o json

$ kubectl get deploy <deployment-name> -o yaml
```

View Deployment Description

```
$ kubectl describe deploy <deployment-name>
```

We can modify generated/updated YAML file

```
$ kubectl edit deploy <deployment-name>

## change replicas: count to any other value then (ESC):wq

# We can modify our YAML file and then execute apply command

$ kubectl apply -f web-deploy.yml

## We can Even scale using command also

$ kubectl  scale  deploy  <deployment-name>   --replicas=<desired-replica-count>
```

Delete Deployment

```
$ kubectl delete deploy <deployment-name>

$ kubectl delete -f web-deploy.yml
```

SERVICE

Service is an abstraction that defines a logical set of pods and a policy to access them. Services enable network connectivity and load balancing to the pods that are part of the service, allowing other components within or outside the cluster to interact with the application.

Service Types: Kubernetes supports different types of services:

1. NodePort: Exposes the service on a static port on each selected node's IP. This type makes the service accessible from outside the cluster by the <NodeIP>:<NodePort> combination.
2. ClusterIP: Exposes the service on a cluster-internal IP. This type makes the service only reachable within the cluster.
3. LoadBalancer: Creates an external load balancer in cloud environments, which routes traffic to the service.

Create service by executing the yaml file

apiVersion: v1

kind: Service

metadata:

 name: my-service

 labels:

  app: my-service

  type: backend-app

spec:

 type: NodePort

 ports:

 - targetPort: 7070

   port: 7070

   nodePort: 30002

 selector:

  apptype: web-backend

```
NAME                            READY   STATUS    RESTARTS        AGE
my-app                          1/1     Running   1 (133m ago)    4h41m
my-pod                          1/1     Running   1 (133m ago)    4h30m
my-rs-9zd7s                     1/1     Running   1 (133m ago)    4h7m
my-rs-fmssw                     1/1     Running   1 (133m ago)    4h7m
my-rs-j68s7                     1/1     Running   1 (133m ago)    4h7m
my-rs-jmkst                     1/1     Running   1 (133m ago)    4h7m
webnginx2-85b94f8d56-jldpk      1/1     Running   0               75m
webnginx2-85b94f8d56-jmnmv      1/1     Running   0               77m
akshitha@ITP-CC16-19:~$ kubectl describe service my-service
Name:                   my-service
Namespace:              default
Labels:                 app=my-service
                        type=backend-app
Annotations:            <none>
Selector:               apptype=web-backend
Type:                   NodePort
IP Family Policy:       SingleStack
IP Families:            IPv4
IP:                     10.108.133.125
IPs:                    10.108.133.125
Port:                   <unset>  7070/TCP
TargetPort:             7070/TCP
NodePort:               <unset>  30002/TCP
Endpoints:              10.244.0.14:7070,10.244.0.17:7070,10.244.0.16:7070 + 1 more...
Session Affinity:       None
External Traffic Policy: Cluster
Internal Traffic Policy: Cluster
Events:                 <none>
akshitha@ITP-CC16-19:~$ minikube ip
192.168.49.2
akshitha@ITP-CC16-19:~$ curl http://<minikube-ip>:30002
-bash: minikube-ip: No such file or directory
akshitha@ITP-CC16-19:~$ curl http://<minikube-ip>:30002
-bash: minikube-ip: No such file or directory
akshitha@ITP-CC16-19:~$ curl http://192.168.49.2:30002
curl: (7) Failed to connect to 192.168.49.2 port 30002 after 0 ms: Couldn't connect to server
akshitha@ITP-CC16-19:~$ curl http://192.168.49.2:30002
curl: (7) Failed to connect to 192.168.49.2 port 30002 after 0 ms: Couldn't connect to server
akshitha@ITP-CC16-19:~$ kubectl get pods -o wide
NAME                            READY   STATUS    RESTARTS        AGE     IP            NODE      NOMINATED NODE   READINESS GATES
my-app                          1/1     Running   1 (136m ago)    4h45m   10.244.0.12   minikube  <none>           <none>
my-pod                          1/1     Running   1 (136m ago)    4h34m   10.244.0.13   minikube  <none>           <none>
my-rs-9zd7s                     1/1     Running   1 (136m ago)    4h11m   10.244.0.16   minikube  <none>           <none>
my-rs-fmssw                     1/1     Running   1 (136m ago)    4h11m   10.244.0.18   minikube  <none>           <none>
my-rs-j68s7                     1/1     Running   1 (136m ago)    4h11m   10.244.0.14   minikube  <none>           <none>
my-rs-jmkst                     1/1     Running   1 (136m ago)    4h11m   10.244.0.17   minikube  <none>           <none>
webnginx2-85b94f8d56-jldpk      1/1     Running   0               79m     10.244.0.20   minikube  <none>           <none>
webnginx2-85b94f8d56-jmnmv      1/1     Running   0               80m     10.244.0.19   minikube  <none>           <none>
akshitha@ITP-CC16-19:~$ curl http://192.168.49.2:30002
curl: (7) Failed to connect to 192.168.49.2 port 30002 after 0 ms: Couldn't connect to server
```

```
| default   | my-service      |               | http://127.0.0.1:40909    |
|-----------|-----------------|---------------|---------------------------|
🎉  Opening service default/my-service in default browser...
👉  http://127.0.0.1:40909
❗  Because you are using a Docker driver on linux, the terminal needs to be open to run it.
^C👻  Stopping tunnel for service my-service.
akshitha@ITP-CC16-19:~$ curl http://192.168.49.2:30002
curl: (7) Failed to connect to 192.168.49.2 port 30002 after 0 ms: Couldn't connect to server
akshitha@ITP-CC16-19:~$ sudo nano deployment.yml
akshitha@ITP-CC16-19:~$ curl http://192.168.49.2:30002
curl: (7) Failed to connect to 192.168.49.2 port 30002 after 0 ms: Couldn't connect to server
akshitha@ITP-CC16-19:~$ minikube service my-service
|-----------|-----------------|---------------|---------------------------|
| NAMESPACE | NAME            | TARGET PORT   |            URL            |
|-----------|-----------------|---------------|---------------------------|
| default   | my-service      |         7070  | http://192.168.49.2:30002 |
|-----------|-----------------|---------------|---------------------------|
🏃  Starting tunnel for service my-service.
|-----------|-----------------|---------------|---------------------------|
| NAMESPACE | NAME            | TARGET PORT   |            URL            |
|-----------|-----------------|---------------|---------------------------|
| default   | my-service      |               | http://127.0.0.1:39197    |
|-----------|-----------------|---------------|---------------------------|
🎉  Opening service default/my-service in default browser...
👉  http://127.0.0.1:39197
❗  Because you are using a Docker driver on linux, the terminal needs to be open to run it.
^C👻  Stopping tunnel for service my-service.
akshitha@ITP-CC16-19:~$ curl http://192.168.49.2:30002
curl: (7) Failed to connect to 192.168.49.2 port 30002 after 0 ms: Couldn't connect to server
akshitha@ITP-CC16-19:~$ curl http://192.168.49.2:30002
curl: (7) Failed to connect to 192.168.49.2 port 30002 after 0 ms: Couldn't connect to server
akshitha@ITP-CC16-19:~$ kubectl get services
NAME         TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)          AGE
kubernetes   ClusterIP   10.96.0.1        <none>        443/TCP          4h46m
my-service   NodePort    10.108.133.125   <none>        7070:30002/TCP   5m6s
akshitha@ITP-CC16-19:~$ kubectl get pods
NAME                            READY   STATUS    RESTARTS        AGE
my-app                          1/1     Running   1 (133m ago)    4h41m
my-pod                          1/1     Running   1 (133m ago)    4h30m
my-rs-9zd7s                     1/1     Running   1 (133m ago)    4h7m
my-rs-fmssw                     1/1     Running   1 (133m ago)    4h7m
my-rs-j68s7                     1/1     Running   1 (133m ago)    4h7m
my-rs-jmkst                     1/1     Running   1 (133m ago)    4h7m
webnginx2-85b94f8d56-jldpk      1/1     Running   0               75m
webnginx2-85b94f8d56-jmnmv      1/1     Running   0               77m
akshitha@ITP-CC16-19:~$ kubectl describe service my-service
Name:                   my-service
Namespace:              default
Labels:                 app=my-service
                        type=backend-app
Annotations:            <none>
```

NAMESPACE

Namespace is a virtual cluster or logical partition within a cluster that provides a way to organize and isolate resources. It allows multiple teams or projects to share the same physical cluster while maintaining resource separation and access control.

COMMANDS

To create a namespace:

$ kubectl create namespace <namespace-name>

$ kubectl create ns my-bank

To switch to a specific namespace: (make this as default type)

$ kubectl config set-context --current --namespace=<namespace-name>

To list all namespaces:

$ kubectl get namespaces

To get resources within a specific namespace:

$ kubectl get <resource-type> -n <namespace-name>

$ kubectl get deploy -n my-bank

$ kubectl get deploy --namespace my-bank

$ kubectl get all --namespace my-bank

To delete a namespace and all associated resources:

$ kubectl delete namespace <namespace-name>

$ kubectl delete ns my-bank

kubectl create ns mydeploy

kubectl apply -f deploy.yml -n mydeploy

Yml file

apiVersion: v1

kind: Namespace

metadata:

  name: my-demo-ns

```
akshitha@ITP-CC16-19: ~                                                                    _  □  X

akshitha@ITP-CC16-19:~$ kubectl apply -f pod.yml
pod/my-pod created
akshitha@ITP-CC16-19:~$ kubectl get pods -n my-demo-ns
NAME      READY   STATUS    RESTARTS   AGE
my-pod    1/1     Running   0          31s
akshitha@ITP-CC16-19:~$ kubectl describe pod my-pod -n my-demo-ns
Name:               my-pod
Namespace:          my-demo-ns
Priority:           0
Service Account:    default
Node:               minikube/192.168.49.2
Start Time:         Thu, 20 Mar 2025 11:39:12 +0000
Labels:             <none>
Annotations:        <none>
Status:             Running
IP:                 10.244.0.23
IPs:
  IP:  10.244.0.23
Containers:
  my-container:
    Container ID:   docker://c4ebc20e8b8b31add23f6dbdee00081afb79fe1e6bbc2c3ceea32ffca1c89369
    Image:          akshitha1910/simplewebapp:latest
    Image ID:       docker-pullable://akshitha1910/simplewebapp@sha256:9b9227b28504a732e5e45d8dc92748f65621fa8f1485f1b6ed0a563966e99a7c
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Thu, 20 Mar 2025 11:39:15 +0000
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-9m7z1 (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-9m7z1:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
```



```
akshitha@ITP-CC16-19: ~                                                                    _  □  X

    DownwardAPI:           true
QoS Class:                 BestEffort
Node-Selectors:            <none>
Tolerations:               node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                           node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason     Age   From                Message
  ----    ------     ----  ----                -------
  Normal  Scheduled  35s   default-scheduler   Successfully assigned my-demo-ns/my-pod to minikube
  Normal  Pulling    35s   kubelet             Pulling image "akshitha1910/simplewebapp:latest"
  Normal  Pulled     32s   kubelet             Successfully pulled image "akshitha1910/simplewebapp:latest" in 2.379s (2.379s including waiting). Image size: 520040333 bytes.
  Normal  Created    32s   kubelet             Created container: my-container
  Normal  Started    32s   kubelet             Started container my-container
akshitha@ITP-CC16-19:~$ kubectl logs my-pod -n my-demo-ns
NOTE: Picked up JDK_JAVA_OPTIONS: --add-opens=java.base/java.lang=ALL-UNNAMED --add-opens=java.base/java.lang.invoke=ALL-UNNAMED --add-opens=java.base/java.lang.reflect=ALL-UNNAMED --add-opens=jav
a.base/java.io=ALL-UNNAMED --add-opens=java.base/java.util=ALL-UNNAMED --add-opens=java.base/java.util.concurrent=ALL-UNNAMED --add-opens=java.rmi/sun.rmi.transport=ALL-UNNAMED
20-Mar-2025 11:39:15.981 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Server version name:    Apache Tomcat/9.0.102
20-Mar-2025 11:39:15.986 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Server built:           Mar 3 2025 19:33:14 UTC
20-Mar-2025 11:39:15.987 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Server version number:  9.0.102.0
20-Mar-2025 11:39:15.987 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log OS Name:                Linux
20-Mar-2025 11:39:15.987 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log OS Version:             5.15.167.4-microsoft-standard-WSL2
20-Mar-2025 11:39:15.987 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Architecture:           amd64
20-Mar-2025 11:39:15.987 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Java Home:              /opt/java/openjdk
20-Mar-2025 11:39:15.987 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log JVM Version:            21.0.6+7-LTS
20-Mar-2025 11:39:15.987 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log JVM Vendor:             Eclipse Adoptium
20-Mar-2025 11:39:15.987 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log CATALINA_BASE:          /usr/local/tomcat
20-Mar-2025 11:39:15.988 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log CATALINA_HOME:          /usr/local/tomcat
20-Mar-2025 11:39:16.002 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: --add-opens=java.base/java.lang=ALL-UNNAMED
20-Mar-2025 11:39:16.002 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: --add-opens=java.base/java.lang.invoke=ALL-UNNAMED
20-Mar-2025 11:39:16.002 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: --add-opens=java.base/java.lang.reflect=ALL-UNNAMED
20-Mar-2025 11:39:16.003 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: --add-opens=java.base/java.io=ALL-UNNAMED
20-Mar-2025 11:39:16.003 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: --add-opens=java.base/java.util=ALL-UNNAMED
20-Mar-2025 11:39:16.003 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: --add-opens=java.base/java.util.concurrent=ALL-UNNAMED
20-Mar-2025 11:39:16.003 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: --add-opens=java.rmi/sun.rmi.transport=ALL-UNNAMED
20-Mar-2025 11:39:16.003 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Djava.util.logging.config.file=/usr/local/tomcat/conf/logging.properties
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Djava.util.logging.manager=org.apache.juli.ClassLoaderLogManager
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Djdk.tls.ephemeralDHKeySize=2048
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Djava.protocol.handler.pkgs=org.apache.catalina.webresources
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Dsun.io.useCanonCaches=false
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Dorg.apache.catalina.security.SecurityListener.UMASK=0027
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Dignore.endorsed.dirs=
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Dcatalina.base=/usr/local/tomcat
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Dcatalina.home=/usr/local/tomcat
20-Mar-2025 11:39:16.004 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Command line argument: -Djava.io.tmpdir=/usr/local/tomcat/temp
20-Mar-2025 11:39:16.037 INFO [main] org.apache.catalina.core.AprLifecycleListener.lifecycleEvent Loaded Apache Tomcat Native library [1.3.1] using APR version [1.7.2].
20-Mar-2025 11:39:16.037 INFO [main] org.apache.catalina.core.AprLifecycleListener.lifecycleEvent APR capabilities: IPv6 [true], sendfile [true], accept filters [false], random [true], UDS [true].
20-Mar-2025 11:39:16.038 INFO [main] org.apache.catalina.core.AprLifecycleListener.lifecycleEvent APR/OpenSSL configuration: useAprConnector [false], useOpenSSL [true]
20-Mar-2025 11:39:16.043 INFO [main] org.apache.catalina.core.AprLifecycleListener.initializeSSL OpenSSL successfully initialized [OpenSSL 3.0.13 30 Jan 2024]
20-Mar-2025 11:39:16.648 INFO [main] org.apache.coyote.AbstractProtocol.init Initializing ProtocolHandler ["http-nio-8080"]
20-Mar-2025 11:39:16.671 INFO [main] org.apache.catalina.startup.Catalina.load Server initialization in [956] milliseconds
20-Mar-2025 11:39:16.767 INFO [main] org.apache.catalina.core.StandardService.startInternal Starting service [Catalina]
```